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PHYSIOLOGY

AS A

BRANCH OF GENERAL EDUCATION

A GRADUATION ADDRESS

DELIVERED AUGUST 1, 1871

BY

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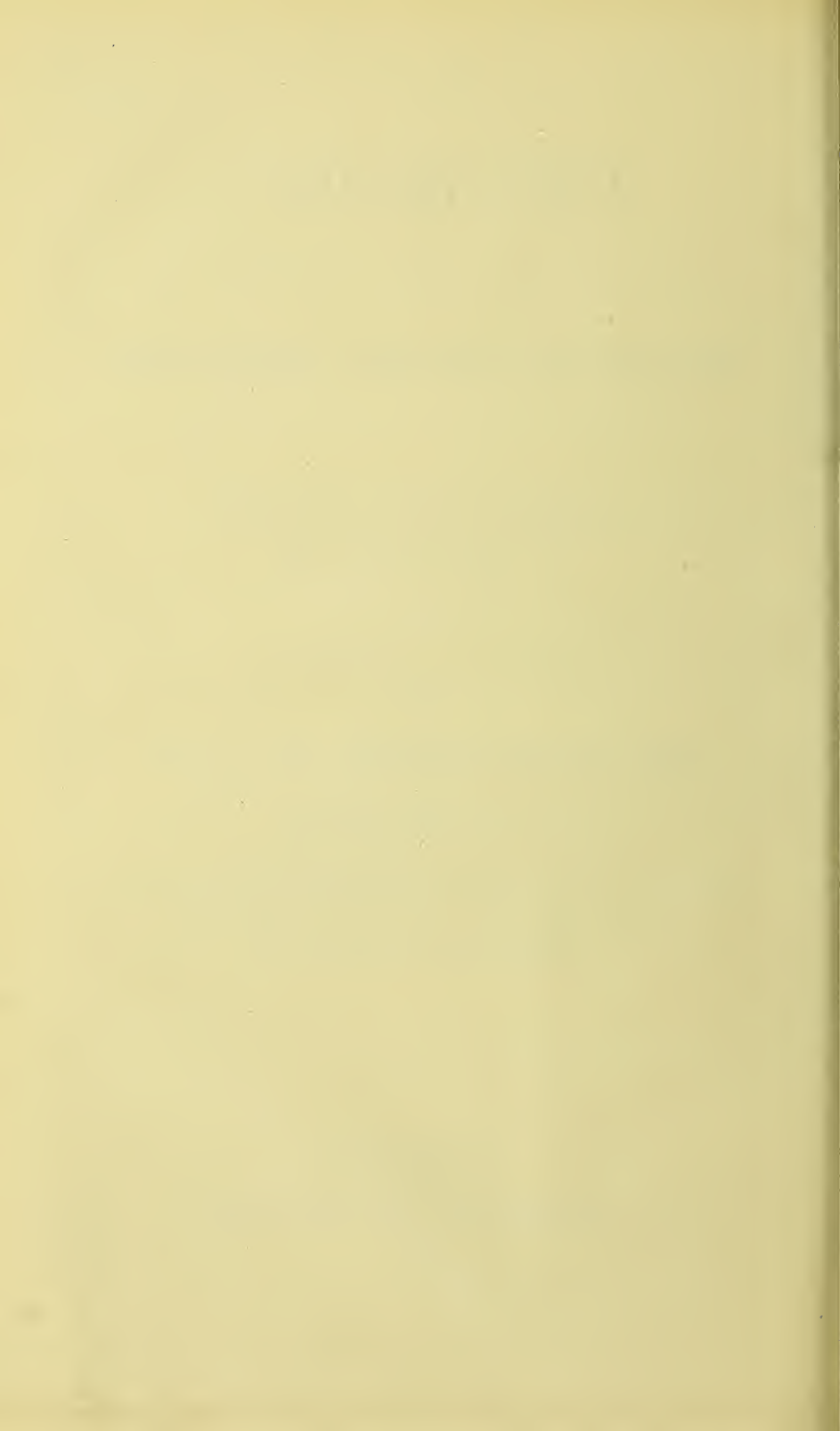
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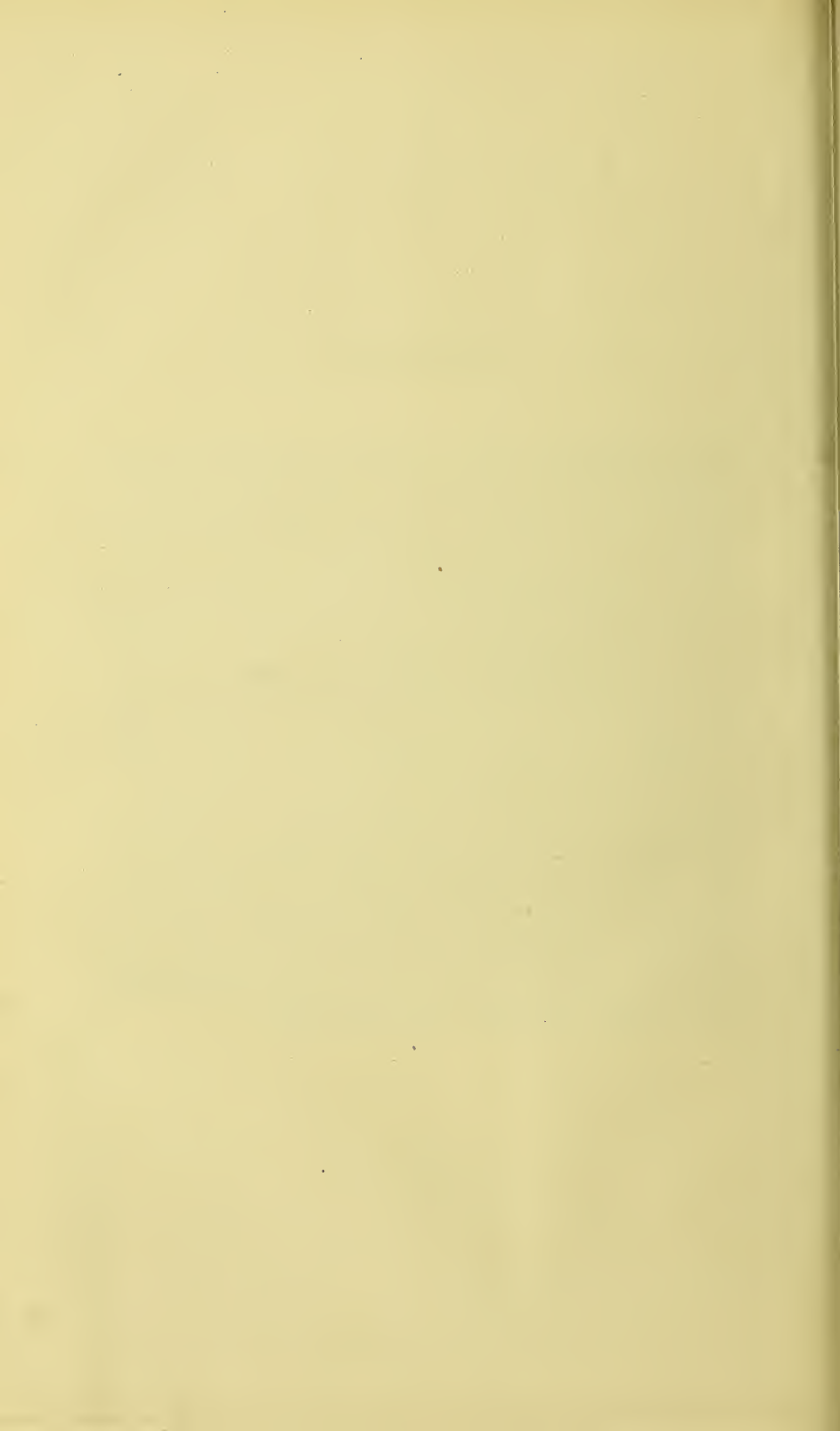
EDMONSTON AND DOUGLAS

1871



SUMMARY.

AFTER describing the nature of a medical education and the duties of a medical practitioner, it is pointed out that there is no subject of which the public are so ignorant as that of the functions of their own bodies, and how to preserve their health. This is shown by their unacquaintance with, and opposition to, the efforts on the part of Government to introduce sanitary laws for their benefit, and illustrated by the unnecessary deaths resulting from scurvy, small-pox, contagious diseases, defective ventilation, and explosive accidents in mines. The only remedy for these and similar misfortunes, it is contended, is teaching mankind the laws of health, and introducing the elements of this science (physiology) into all our schools, high and low, as a necessary branch of education. The clergy are especially exhorted to study the subject, 1st, with a view of diminishing the difference in thought existing between literary and scientific men ; and 2d, because their influence on the people from the pulpit, and as parish ministers, is so important. All other professions and trades, however, might beneficially study physiology. It is particularly recommended to women. The medical graduates, therefore, as men liberally educated both in letters and in science, are requested to aid the educational movement now in progress for communicating a knowledge of the natural sciences, and more especially of physiology, or the laws of health among the people at large, and extending the progress of knowledge in the Spirit of Truth.



A D D R E S S.

MY LORD CHANCELLOR, VICE-CHANCELLOR,
AND GRADUATES IN MEDICINE—

ON two previous occasions I have had the honour of acting as Promotor of the Medical Faculty, and of addressing the newly-made Graduates. On the first of these, in 1849, I entered into the Ethics of our profession, and pointed out to the young men about to practise it the importance of cherishing a feeling of responsibility ; of prosecuting the art and cultivating the science of Medicine in a spirit of sincerity and of truth ; and that they should be strongly imbued with a sense of duty and of moral obligation.* These rules of conduct are as binding on the medical practitioner, and admit of as forcible illustration now, as they did then. I shall, however, at present only remind you that “circumspection, prudence, sobriety, kindness, delicacy of feeling, and above all, that great Christian precept, to do unto others as you would that they should do unto you, ought prominently to distinguish those who treat the sick. These are considera-

* See *Clinical Lectures on the Principles and Practice of Medicine*, by the Author. Fifth edition, p. 1015.

tions of primary importance and obligation. As such I assume that you regard them, and that you will ever make it your sincere desire and endeavour to keep them practically in remembrance.”

On the second of these occasions, in 1860, we had just gone through a remarkable crisis: two acts having passed the Legislature—the one regulating the Medical affairs of the country, and the other regulating the Scottish Universities. I pointed out the rights and privileges which for the first time were conferred on the Students and Graduates of this Institution, and described at some length the struggles and opposing claims of Universities and Corporations.* The loose way in which corporation licenses were then granted constituted at that time a gross scandal. A large number of their holders overran the provinces of England, and assumed the title of an Edinburgh Doctor of Medicine, much to the injury of this University, and greatly to the distrust of all corporate bodies among the medical practitioners in the southern parts of the kingdom. I therefore advised your predecessors, as I now do you, to show forth on all proper occasions the difference between the status occupied by those who have graduated in this University, and those who have, with the licenses referred to, falsely assumed the titles which you, by your long and expensive education, your earnest study, and successful examinations, have justly acquired.

* *Universities and Medical Corporations under recent Acts of Parliament.* An Address, etc. Fourth edition. A. and C. Black, 1861.

The great question of the day is undoubtedly that of education, and on this occasion I propose pointing out how the instruction which you have received renders it incumbent upon you not merely to prosecute the professional duties of a medical man, but at the present juncture actively to assist the efforts now being made by men of science, to place the general culture of the youth in our country on a proper foundation. At this moment a great movement is on foot, which is daily assuming more importance as its necessity becomes manifest. It mixes itself up with legislative enactments, with party politics, with the health of towns, with our national resources, with the prosperity of our race. It consists in the advancement and diffusion of that knowledge which comprehends the health and welfare—the physical and moral improvement of man ; and, keeping such an object in view, let us examine for a moment how your studies tend to its accomplishment.

This University exacts that, before commencing a medical education at all, every student should pass an examination in English, Latin, Arithmetic, the Elements of Mathematics and Mechanics, and at least two of the following subjects—viz., Greek, French, German, Higher Mathematics, Natural Philosophy, Logic, and Moral Philosophy.

Four years are then to be spent in acquiring various kinds of knowledge, such as the structure, functions, and classification of plants ; of Natural History, comprehending a general acquaintance with meteorology, mineralogy, geology, and zoology, or the structure and

functions of the lower animals ; of Chemistry, that is the chemical constitution of inorganic and organic nature ; and, more especially, of the Anatomy and Physiology of the human body. An acquaintance with these sciences is only preliminary to the technical acquirement of a knowledge of diseases—surgical and medical—the means of curing them, and the experience that is to be acquired in an hospital for the sick. Now, there is no education anywhere that can compare in extent and variety with this.

You are especially expected to know, with all the exactitude and precision which modern Physiology teaches, every action and function of the living human body. You must understand that process by which the vegetable or animal matter which man consumes is converted into the substance of his frame. You must be thoroughly familiar with the manner in which the nutritive fluid, or blood, is carried in a continuous circulation into every part of his constitution. You must comprehend the chemical composition of the air he breathes, in order to renovate his blood, to bring oxygen into combination with all parts of the frame, so that it may evolve heat and keep up his temperature. You must be acquainted with the varied position, forms, and actions of those muscles by which he is enabled spontaneously to move himself about in all directions, and give effect to his voluntary powers. You must learn all that relates to the wonderful process by which the countless variety of plants and animals are disseminated on the surface of the

globe, and the precautions requisite for securing the development and growth of the young and the perpetuation of our race. You have to study the mechanism of that voice by which man communicates with his fellows; of that oral language and speech which permits him to formularise his thoughts, and of the mechanism of that hand wherewith he transmits them in legible signs from father to son,—a legacy to posterity. You must know all that relates to that remarkable property of the nerves which enables them, when stimulated, to convey influences between the brain and various organs of the body. You must master the structure and functions of the organs of sense; of that eye which receives in its dark chambers the vivid pictures of an external world, and communicates to the human face its chief intellectual expression; of that ear, in the minute bony cavities of which, nervous processes vibrate, responsive to the harshest noise or sweetest melody; of those nervous twigs subservient to the delicate smell, taste, and touch; lastly, of that fine muscular sense whereby we balance our bodies in standing, walking, running, dancing, throwing, etc., and execute all the skilful works of the artisan, artist, and musician. These six senses furnish to man the materials of thought or reasoning—that wonderful power, so vastly superior in him, that he is thereby alone distinguished from all other living beings. Well may the great dramatist say of a creature so endowed, “What a piece of work is man—how noble in reason! how infinite

in faculty! in form and moving how express and admirable! in action how like an angel—in apprehension how like a god! The beauty of the world—the paragon of animals!”

Gentlemen, it is this reason, those faculties, that form, with its moving and active properties, which constitute your special study; and the intellectual gratification you derive from it is enhanced by the conviction that all this knowledge is the basis of a great practical art—the truly godlike art—of relieving pain, curing diseases, and preserving life. You are called upon to remedy the disorders of this complex machine, under all the varied circumstances of climate, age, sex, and condition. You are the regulators of all establishments for the sick and insane. You are called upon to advise legal tribunals in the administration of justice. Your opinions necessarily govern the sanitary condition of armies and fleets, of cities, and indeed of nations. Rich and poor, high and low, must at one period or another of their existence seek your assistance; for you are alike the guardian of the race during the dangers of birth and infancy, as well as its supporter, consoler, and friend at the inevitable hour when vitality ceases, and dust returns to dust.

You will not have exercised these important functions long without being struck with the fact that, although human life is generally admitted to be a matter of the greatest importance; that while for its prolongation and preservation, each individual taxes

his utmost energies ; and that for its defence an army of law-agents, from the judge to the policeman, are remunerated by the State,—there is perhaps no subject with which mankind in general, either as individuals or as communities, are so little acquainted as that which relates to their own health. In all efforts to ameliorate those conditions which your education teaches are so injurious, many difficulties will be met with, most of which arise from the prejudice and opposition originating from ignorance of well-known facts, and the profound carelessness this engenders. On the one hand, you will find every one professing anxiety to avoid disease and secure health ; while, on the other, they are so ignorant and thoughtless, that an enormous number of deaths occur annually which might readily be prevented. It is only too easy to give striking illustrations of this.

The great frequency and fatality of scurvy in former times was the dread of armies, and especially of navies. Admiral Hosier, who set sail in April 1726, with seven ships of the line for the West Indies, buried his ship's company twice over, and was so affected by the failure of his expedition in consequence, that it is alleged he himself died of disappointment. In 1746, Lord Anson, on his return from a four years' cruise, reported that he had lost from this disease no less than four out of every five sailors in his fleet. It was first shown by the distinguished navigator Captain Cook, in 1775, that, by proper attention to the diet of the sailors, this dreadful

disease could be prevented. In a voyage of three years and eighteen days, in all climates, with a company of 118 men, he brought them back to England with the loss of only one individual. Nevertheless five years afterwards, in 1780, Admiral Geary, in a cruise of only ten weeks with the Channel Fleet in the Bay of Biscay, returned to Portsmouth with 2400 sailors affected with scurvy. It was not till 1795, when the Channel Fleet, under Lord Howe, was so affected with it as to destroy the efficiency of every ship under his command, that anything was done by Government to check the disease. It was well known that if, at that period, the enemy had been aware of the disabled condition of the crews, the boasted maritime superiority of this country would have received a great shock. The panic that existed led to new rules for victualling the navy, which at once, and suddenly, succeeded in practically extinguishing the dreaded disease in our ships of war.

Such, then, is an example of a most fatal disease being eradicated by simply adopting a proper diet. Yet it is to be observed that, although these facts are well known, are universally taught in our medical schools, and have been rendered compulsory by Government in victualling the navy, the general ignorance of them has led to constant epidemics of this disease in prisons, asylums, in towns, and among railway labourers. Even at this moment, in our Mercantile Marine, proper rules of diet are little attended to, and as a consequence naval hospitals,

and especially that at Greenwich, receive annually numerous severe cases of the disease, which it has been clearly demonstrated can be prevented by following the simplest rules of diet.

Surely two things, then, are here proved—viz. the necessity for the interference of Government to protect the lives of an ignorant and careless people; and 2d, the propriety of general instruction in those sanitary principles of such vast importance to the public welfare.

The history of vaccination is perhaps still more instructive. It is unnecessary to describe minutely the miseries, horrors, and ravages, which the historians of the last century have informed us resulted from small-pox. It was calculated that 210,000 individuals fell victims to it annually in Europe. When it attacked villages previously unaffected or half-civilised and savage tribes, the entire community was frequently swept away. The nearest relatives and dearest friends of the infected often sought safety in flight. The capital of Thibet, on one of these occasions, was deserted by its inhabitants for three years. Another epidemic, in Russia, destroyed in a single year two million people. At Constantinople, it destroyed one half of those attacked. The *ordinary* death-rate produced by the disease is one out of every four affected; and of those who recover, a large proportion are rendered blind or deaf, while the features of others are so distorted and deformed as no longer to be recognisable.

It was in 1798 that Jenner first published to the world his discovery of vaccination, and such was the dread mankind everywhere felt of the small-pox, that the remedy he proposed rapidly spread over Europe. In 1802, the practice of vaccination was common throughout Asia, and in other three years it had reached the whole of the civilised world. Everywhere, except at home, it was received with an enthusiasm and gratitude of which we can now form no conception. Dignities and rewards were showered upon the discoverer by every foreign government. Napoleon set several prisoners free at the mere request of Jenner, and allowed passports granted by him, in that time of universal war, to confer a protection on travellers which their own powerful governments were unable to afford. Indeed, every nation united to do him honour. Even the wild Indians in Upper Canada, at an assembly of the five nations, sent him a large belt of Wampum, assuring him that they should not fail to teach their children to lisp the name of Jenner, and to thank the Great Spirit for bestowing upon him so much wisdom and so much beneficence.

At home, however, he was the victim of numerous attacks and intrigues, and, like Harvey, who discovered the circulation of the blood, lost his practice and was nearly ruined by his philanthropic endeavours to benefit others. Although a Committee of the House of Commons had reported that the practice of vaccination was of the most general utility, and that it tended to eradicate, and, if its use became universal, would ab-

olutely extinguish one of the most destructive disorders by which the human race has been visited, a motion made that he should receive £20,000 from the nation was lost by a majority of three votes. Ultimately he received £30,000, a sum which may be regarded, I suppose, as the value then set upon a medical man's life devoted to prosecuting and carrying out an original discovery, one that annually saves the lives of 80,000 British subjects, and which Admiral Berkeley, Chairman of the House of Commons Committee, declared was superior to that of the longitude, and unquestionably the greatest ever made for the preservation of the human species.

But, notwithstanding his efforts to spread the benefits of vaccination among mankind, he had to encounter not only the opposition of those who doubted its utility, but the apathy of the masses when the utility was admitted. The former not only undervalued his discovery, but calumniated his motives and traduced his character. They denounced the practice of vaccination to be "repugnant to religion, morality, law, and humanity." Large associations were formed to prevent its adoption. The pulpit resounded with attacks on the impious and presumptuous man who dared to interfere with the wise punishments inflicted by Providence. The introduction of a disease from a cow, it was asserted, would communicate to the human race every brutish propensity. Caricatures of men and women, with bovine features and horns, were in every shop-window; and, excited by the clamour occasioned,

there were riots of the people, who pelted the vaccinators with stones.

The present generation, to whom small-pox is almost practically unknown, must regard this frenzy of the multitude as only an evidence of their profound ignorance. The more so, that notwithstanding the safety which they had the means of enjoying, their apathy and neglect exposed them to frequent epidemics of the disease. In 1825, one of these occurred in London, and destroyed 1300 persons. In Sweden, France, Germany, and Italy, similar attacks prevailed. At length Germany and other foreign governments made vaccination compulsory on the population, and re-vaccination has been largely practised as a further protection against the disease. The good effects of these measures became immediately apparent. So difficult, however, was it to persuade the people to vaccinate their children, that the disease was again becoming prevalent, when, in 1853, the Vaccination Act passed the Legislature. In England its provisions were of a kind that admitted of many evasions, but the Scotch and Irish Acts, which were more stringent, have worked so well, that there can be no doubt the disease is being gradually exterminated. Only last summer a panic rose in this country that small-pox was about to return, and a large number of re-vaccinations were practised. But whilst in Paris and London considerable numbers fell victims to the disease, we enjoyed comparative immunity from it in Scotland; so that the vast advantage resulting from Government interference, and compelling the people,

against their will, to take the necessary precautions for their own benefit, can no longer be doubted.

Now there is another disease which, for malignancy and destructiveness, may be said to vie with small-pox, but which from its insidious and secret character, is only fully known to medical men. Formerly it was more deadly to our armies and navies than the cannon and bayonets of a first-rate power. So late as 1864, it existed in our army to such an extent that Dr. Parkes states that it is equal to the constant loss of two regiments. In 1862, 7000 sailors were affected with it in the home stations alone. In the civil community the torments, unhappiness, and mortality occasioned by it are incalculable. Here, also, the Governments of Europe have interfered with the most universal success, and in 1864 our own Legislature partially did the same. The result has been eminently satisfactory, and under the influence of enforced cleanliness and isolation, the disease has been largely mitigated and immorality decreased.

Nevertheless at this moment the most violent opposition is made to the philanthropic efforts on the part of Government to lessen human misery, and similar arguments are employed as were brought forward to prevent vaccination. It is said that in our efforts to diminish this disorder, we are impiously striving to take the rod out of the hand of God, and that in relieving the more degraded class of sufferers we are crushing the seeds of self-respect which they might otherwise possess. The enthusiasts who take

part in this agitation know nothing of the horrors and deadly character of the disease which is sought to be ameliorated. With them a theory of sin and its punishment, only worthy of the cloister, or a false delicacy which, in face of disease and death, is absolutely culpable, constitute the ground for interference with rules as necessary for the suppression of *this* disease, as are those framed for the destruction of scurvy and small-pox.*

These examples must show you the utter uselessness of supposing that sanitary laws will ever be followed by the public so long as they remain ignorant of the rudiments of that knowledge necessary for the preservation of their own lives.

The constant explosions in our mines, many years ago, led Sir Humphry Davy to place in the hands of the workmen a lamp, properly called the safety-lamp, with which they could work with impunity

* It is assumed by some that the moral injury likely to be produced by the Act outweighs the sanitary advantages it confers. I venture to think they are in error, 1st, Because most of them admit, and all experience proves, that they are unable to diminish, much less suppress the immorality; and 2d, Because they are imperfectly acquainted with the horrors of the dreadful disease capable of being ameliorated by the measure. Such ladies as are specially opposed to it, are, undoubtedly, ignorant of the facts of the case, and such is the nature of the evil sought to be remedied, that they cannot be instructed regarding it. I would advise the male objectors to consult in some medical library the plates of Devergie (*Clinique de la Maladie Syphilitique*. Atlas, 4to. Paris, 1833), and then ask themselves seriously how they are justified as practical and charitable individuals in trying to prevent the legislature from circumscribing and eradicating such fatal contagious maladies, because of the fanciful notions they entertain.

amongst the most explosive gases. But no persuasion, no danger to themselves, could prevail on the men to use it ; and the consequence is that even now we constantly read of the most deplorable accidents, where hundreds of lives are sacrificed to ignorance and inattention, giving rise to wide-spread distress among numerous families.

On the 1st of December 1848, the deck-passengers on board the Irish steamer "Londonderry" were ordered below by the captain, on account of the stormy character of the weather, and the hatches were so closed down upon them that they could not breathe. The consequence was that, out of 150 individuals, no fewer than 70 were suffocated and found dead next morning. An unacquaintance with the laws of respiration and ventilation was evidently the cause of this and of similar disasters that might be referred to. It is well known that the model lodging-houses in St. James', Westminster, were all supplied with excellent ventilators, the valves of which were deliberately pasted over with paper by the occupants. All efforts made to throw fresh air into the crowded rooms of artisans, for the benefit of their health, have been rendered useless by the men themselves, through ignorance, blocking up and destroying the arrangements intended for their own benefit. But enough has been said to demonstrate how a disregard of the laws of health is destructive to the people of this country, 120,000 of whom lose their lives annually from causes which might readily be prevented, also producing colla-

teral misfortune to others which it is impossible to calculate.

What, it may be asked, are the causes of this utter unacquaintance with those principles which, at first sight, would appear to be of primary and universal importance to man's welfare and social existence? This subject, though one of a delicate character, we must not shrink from entering into. At the congress of naturalists and medical men held at Innspruch in 1869, Helmholtz claimed for Germany the principal agency in the progress of modern science. She owes this superiority, he said, to the boldness of her savans in propagating truth, whilst, he asserted, that in England and France they dare not do so openly, for fear of compromising their social interests. But I trust the time is past, even in Scotland, when scientific truth has anything to fear from superstitious bigotry or clerical intolerance. It is true we are constantly hearing that there is a tendency to place new scientific doctrines in opposition to religious beliefs. But I would suggest that THE CAUSE OF THIS IS NOT THAT SCIENTIFIC MEN ARE IRRELIGIOUS, SO MUCH AS THAT RELIGIOUS MEN ARE UNSCIENTIFIC. It is utterly impossible, in these days, to oppose the most obvious facts, or persecute the great discoverers of the day, because the writers of the Old and New Testament, 1800 or 3000 years ago, knew little of astronomy, chemistry, and physics. Such, however, has been the unfortunate policy of the Church for many centuries. I need not remind you that the great Galileo died a prisoner o

the Inquisition, and that Servetus was publicly burnt in Geneva, by the authority of Calvin.*

The true cause, unquestionably, of the present chasm in thought, which divides the literary and religious from scientific men is, that the former have been bred up in ignorance of the natural sciences, and especially of Physiology, that is, of all that relates to their own bodily structure, functions, and requirements. Indeed, it is now very generally admitted that this kind of education has been rendered too exclusive, and led to a widespread want of appreciation and an incapacity of comprehending scientific truths. Classical and literary studies foster taste, the reading of imaginative works, including poetry, and most histories and biographies; it may lead to a cultivation of art, of all that supports the elegancies of life, and keeps up a metaphorical mode of speech and inexactitude of language, which has descended to us from the earliest times. The ancients believed that life was an immaterial principle that might be added to or taken away from the body, as exemplified in the fable of Prometheus, who animated the marble statue with fire stolen from heaven. They thought that the mental faculties and feelings were seated in the internal organs of the body. So old and so widely spread were these hypotheses, that they still keep a hold of the literature and

* Servetus was a medical practitioner and a physiologist. The book *Christianismi Restitutio*, for publishing which he was executed, contained, among other heretical matters, the most correct account of the circulation of the blood ever given before that of Harvey.

colloquial language of every people. Hence the terms, "vital spirit," "spark of life," and so on; while the heart, the liver, the spleen, the bowels, the reins, and other viscera, are referred to literally or metaphorically, as so many seats of mental faculties or moral feelings. We talk of the emotions of the heart as representing a state of mind distinguished from the reasoning powers.* It is unnecessary to allude to the folly of supposing that life, as we study it, can exist independent of matter—or that the heart and liver are seats of moral faculties. This loose and vague kind of language renders those who use it upholders of all kinds of error. Indeed these are the class of persons everywhere most

* "The heart has its arguments, with which reason is not acquainted. It is the heart which feels God, and not reason. This is perfect faith—God-known to the heart."—PASCAL.

"Shall I in London act the noble part?
Composing songs for fools to get by heart."—POPE.

"How many cowards whose hearts are all as false
As stairs of sand, wear yet upon their chins
The beards of Hercules and frowning Mars;
Who inward searched, have livers white as milk."
SHAKSPEARE.

"My knight, I will inflame thy noble liver,
And make it rage."—SHAKSPEARE.

"My presence may well abate the over-merry spleen."
SHAKSPEARE.

"By the gods you shall digest the venom of your spleen,
Though it doth split you."—SHAKSPEARE.

"I am in distress; my bowels are troubled."—LAMENTATIONS i. 20.

"Yea, my reins shall rejoice."—PROVERBS xxiii. 16.

intolerant, because they are least capable of comprehending scientific laws and scientific evidence—steam-engines, railways, geology, the circulation, vaccination, ventilation, and other things dependent for their appreciation on scientific knowledge they have ridiculed, because they could not comprehend the possibility of occurrences which are to them unintelligible. The same opposition governs their conduct in opposing the Contagious Diseases Act, as in criticising the theory of Darwin. One of these literary gentlemen, known as a historian, told us last spring, that while Calvinism was alike “repugnant to reason and to conscience, and turned existence into a hideous nightmare,” nevertheless it had governed the conduct of many great men, especially religious reformers, including such individuals as Buddha, Confucius, Moses, Zoroaster, Mahomet—he did not, I think, mention Brigham Young.* But this literary gentleman could not develop his remarkable theory without attacking the nature worship of ancient Egypt, and observed, “that even in this day we need not ridicule popular credulity, because the ablest of living natural philosophers is looking gravely to the courtships of moths and butterflies, to solve the problem of the origin of man, and to prove his descent from an African baboon.” Now a knowledge of physiology would have taught that gentleman that the worship of natural objects by the ancient as well as by the modern Pagans is only

* Froude on Calvinism. An address to the University of St. Andrews.

symbolical of observed facts, and typical, more especially, of astronomical and physiological laws, and that these, as well as the facts and theory of Darwin, are as incomprehensible to the mere classical and literary student, as are railways and telegraphs to an inhabitant of the Fidjee Islands.* It is even probable that the uncultivated mind of the savage would be more open to scientific truth than the routine intellect of the classic and of the abstract philosopher. The first might not be so struck with the impossibility of a man springing from a baboon if he saw them side by side; whereas, if you showed to a classical scholar or a metaphysician a hen's egg in juxtaposition with a living fowl, he could not explain to that savage the common process by which the one is transformed into the other. It is not by classical minds, nor by so-called speculative philosophers,† that the scientific labours of such a man as Darwin can be rightly estimated.

It too frequently happens that clergymen and religious teachers are insensible to the errors and discrepancies of language they use in the pulpit; so that, when the scientific man takes his place in church, he is surprised at the manifest disregard of established

* Indeed the mythologies of ancient nations remain absolutely barren, even to the scholar, unless a meaning is given to them by an acquaintance with physiology and the natural sciences.

† By abstract or speculative philosophers I understand the metaphysicians and mental philosophers who base their assumptions on imagination or innate thought, and ignore facts and scientific investigations.

truths constantly preached to the people. As a simple illustration of this, let me remind you of a beautiful hymn with which all of us have been acquainted from childhood, and which is still sung in our churches. It is the one which commences—"The spacious firmament on high;" and, after referring in separate verses to the sun, moon, stars, and planets, says, in the fifth verse—

"What though, in solemn silence, all
Move round the dark terrestrial ball," etc.

But there is no one among this audience whose knowledge has not convinced him that, so far from the sun and the heavenly bodies moving round the earth, or "terrestrial ball," the earth and planets in fact move round the sun. If Addison, the author of this hymn, had consulted a scientific friend, and, instead of the "dark terrestrial," had substituted the *splendid solar ball*, the hymn would have sung just as well, and would have had the advantage of being more correct, if not absolutely right.*

* This passage has been much criticised, and it has been argued that the commonly used expression of the sun rising and setting causes no confusion in our ideas. It has also been asked what would become of the realm of poetry, if only accurate statements were adhered to. My object is not to suppress imagery and metaphor in language or poetry, still less to undervalue literary culture and those beautiful conceptions which give to

"Airy nothing
A local habitation and a name,"

but to point out that indulgence in them is unfavourable to scientific thought, and the furtherance of those endeavours which have practical utility and truth for their object. With regard to the Scriptures innumerable discussions have occurred, and differences of opinions are

Unquestionably, there is no one who possesses such influence and moral control over the people as the clergyman. How important is it, therefore, that he should be instructed in the laws which govern that body and that life, of which he is constantly speaking in the pulpit. He could then teach his hearers that natural laws are God's laws, and that the Scriptures, old and new, direct men to be as careful of the body as of the soul.* Indeed, the great fact on which

still held as to what is matter of fact and what is metaphorical. It is not long since that a learned judge is reported to have inculcated that inspiration ought to be regarded as applicable to the religious and moral doctrines of the sacred writings, and not to their historical and scientific details. Much is hoped for from the committee appointed by Convocation for the revision of the authorised version of the Scriptures. "It has been divided into two bodies—one to undertake the revision of the Old, and the other of the New Testament. The former consists of the Bishops of St. David's, Llandaff, Ely, Lincoln, and Bath and Wells, Archdeacon Selwyn, Canon Selwyn, Dr. Jebb, and Dr. Kay. The latter consists of the Bishops of Winchester, Gloucester, Bristol, and Salisbury, the Prolocutor of the Lower House, and the Deans of Canterbury and Westminster, and Canon Blakesley. The list of scholars and divines invited to join the Old Testament company includes the names of Professor Davidson, Perowne Leathes, Dr. Pusey, and Dr. W. L. Alexander. Among the scholars and divines invited to join the revision of the New Testament, one of the most notable names is that of the Roman Catholic, Dr. J. H. Newman."—*Scotsman*, June 4, 1870. It is to be regretted that there is no scientific man on the committee.

* "Your bodies are members of Christ." "He is the Saviour of the body." "The body is for the Lord, and the Lord for the body." "Your body is the temple of the Holy Ghost, which is in you, which ye have of God." We must "glorify God in our body." We must "present our bodies, living sacrifices, holy and acceptable; which is our reasonable service." "So ought men to love their wives, even as their own bodies," etc. etc. See also several chapters of Leviticus.

our religion is founded was not the immortality of the soul, but the resurrection of the body. Surely this circumstance alone, not to speak of physiological knowledge in modern times, ought to check those cruelties which certain religious sects inflict on their own persons, under the idea—derived from the Greek and other heathen speculative Philosophers—that the bodily is opposed to the spiritual nature, and that injury of the one is beneficial to the other. Our parochial clergy, whatever erroneous theory they may derive from their classical studies, happily practice a different doctrine. For, by supplying the material wants of the poor, interesting the richer classes in their welfare, and exerting themselves to the utmost in relieving their distresses, they act with an energy alike honourable to their feelings as men, as it is in harmony with the precepts and practice of their divine master. But what incalculably greater good would they effect, if, in addition to their actual knowledge, they were more generally acquainted with what is known as to the laws of life, the causes of death, the proper means for averting disease, and the influence which the body and the mind exert upon each other!*

* It has been represented that in thus specially alluding to the clergy I am censuring the universities which admit them, and give to more than half of them the degree of Master of Arts. There is too much justice in this remark. Of late years however, these institutions have become alive to the necessity of causing their students in arts to pay attention to natural science. My object is not, as has been alleged, to attack clergymen or any other class of professional men, but by indicating their deficient *scientific* and more especially deficient *physiological knowledge*—which as a rule cannot be disputed—to induce the

It were easy to point out how, not only the clergy, but all professions and all ranks of the community might in like manner be benefited by a similar acquaintance with physiological truth. Our statesmen would frame better laws for the benefit of the people—our magistrates would more intelligently promote the health of their towns, and not pollute our rivers and estuaries by wasting matter which, if given to the earth, would be a source of wealth—our architects would be anxious to secure good ventilation in their buildings rather than mere ornament—our generals and admirals would insist on efficiency in providing food and comforts for their soldiers and sailors, and busy themselves in procuring proper appliances and skilful surgeons for the wounded—our manufacturers would introduce less crowding and more ventilation into their workshops—our literary men would lend their talents to the diffusion of scientific discovery, and our newspaper editors would dwell at greater length on those topics which instruct the public in the laws of health. It is only when the people become intelligent supporters of the great questions which are directed to the health of communities and improvement of the race, that it would become impossible for designing or one-sided persons to lead

universities and schools to teach the latter more generally. It has been proposed that the student in arts should qualify himself to a certain extent by attending two scientific classes out of five, physiology being one of these. I contend that it should be considered necessary part of every kind of education that something should be taught of the mechanism and functions of the human body.

them astray, or waste their resources on injurious, extravagant, or impracticable schemes.

A careful consideration of these and numerous similar topics, which it is impossible to introduce into a discourse of this kind, has satisfied many thoughtful minds that physiology in some form or other should constitute a part of the education of every one.* A Committee of

* Mr. John Stuart Mill says, in his address to the University of St. Andrews, in 1868, speaking of sciences which should be introduced into general education, "The first is physiology: the science of the laws of organic and animal life, and especially of the structure and functions of the human body. It would be absurd to pretend that a profound knowledge of this difficult subject can be acquired in youth, or as a part of general education, yet an acquaintance with its leading truths is one of those acquirements which ought not to be the exclusive property of a particular profession. The value of such knowledge for daily uses has been made familiar to all by the sanitary discussions of late years. There is hardly one among us who may not, in some position of authority, be required to form an opinion and take part in public action on sanitary subjects, and the importance of understanding the true conditions of health and disease, of knowing how to acquire and preserve that healthy habit of body which the most tedious and costly medical treatment so often fails to restore when once lost, should secure a place in general education for the principal maxims of hygiene, and some of those even of practical medicine. For those who aim at high intellectual cultivation, the study of physiology has still greater recommendations, and is, in the present state of advancement of the higher studies, a real necessity. The practice which it gives in the study of nature is such as no other physical science affords in the same kind, and is the best introduction to the difficult questions of politics and social life."

Sir James Paget observes, in his lecture "On the importance of the study of Physiology as a branch of education for all classes," delivered at the Royal Institution of Great Britain, "One who is conversant with things that have a purpose in the future, higher than that which they have yet fulfilled, would never think that his own highest des-

the British Association for the Advancement of Science strongly recommended it in 1868, and wherever it has been tried it has been attended with marked success, especially in girls' schools. Perhaps women in all classes and degrees of society have more to do with the preservation and duration of human life even than men. It has been argued that inasmuch as even the brutes know instinctively how to take care of their young, so must women be able to do the same. But the human infant is the most helpless of creatures, and nothing is more lamentable than to witness the anxieties and agony of the young mother as to how

tiny is yet achieved, though his place among men might be only like that of a single particle—like that of a single blood-cell of the body—yet would he strive to concur, and take his share in all progressive good. Nor would he count that, with this life ended, his purpose would be attained; but by teaching or by record, or by some other of those means through which in the history of our race things that in their rudiments seemed trivial have been developed into great results, he would strive “to achieve at least some useful work, the fruits whereof might abide.” Conscious of an immortal nature, and of desires and capacities for knowledge which cannot be satisfied in this world, he would be sure that the great law of progress, from a lower to a higher state, would not be abrogated in the Divine government of that part of him which cannot perish, and is not yet perfect. In him even the understanding would be assured that, “as we have borne the image of the earthy, we shall also bear the image of the heavenly,” for that is the true lesson of development.”

“And because it abounds in lessons such as these, I claim for physiology the pre-eminence among all sciences, for the clear and full analogies which it displays between things natural and things revealed; and I would teach it everywhere, looking to its help, by these analogies, to prove the concord between knowledge and belief, and to mediate in the ever-pending conflicts of intellect and faith.”

she should manage her first-born. In no system of education are women taught the structure and requirements of the offspring which will be committed to their charge; and certainly no error can be greater than to suppose that the senses and instincts are sufficient for teaching man as to his physical, vital, and intellectual wants. The enormous loss of life among infants has struck all who have paid attention to the subject, and there can be no question that this is mainly owing to neglect, want of proper food or clothing, of cleanliness, of fresh air, and other preventable causes. Dr. Lankester tells us, when ably writing on this topic, that, as coroner for Central Middlesex, he holds one hundred inquests annually on children found suffocated in bed by the side of their mothers, and he calculates that in this way 3000 infants are destroyed in Great Britain annually alone, attributable in nine cases out of ten to the gross ignorance of those mothers of the laws which govern the life of the child.*

But women are the wives, and regulators of the domestic households. They also constitute the great mass of our domestic servants. On them depends the proper ventilation of the rooms, and especially the sleeping-rooms, in which all mankind on an average spend one-third of their lives. Children are too often shut up all day in crowded nurseries, and when ill, are subjected to numerous absurd remedies before medical assistance is sent for.

* See his excellent pamphlet—*What shall we teach? or Physiology in Schools*, London. Groombridge and Sons, 1870.

Their clothing is often useless or neglected, the dictation of fashion rather than of comfort and warmth being too frequently attended to. The cleanliness of the house also depends on women, and the removal of organic matter from furniture and linen, the decomposition of which is so productive of disease. Further, the proper choice and preparation of food is entrusted to them,—all these are physiological subjects, the ignorance of which is constantly leading to the greatest unhappiness, ill health, and death. Among the working classes it is too frequently the improvidence and ignorance of the women which lead to the intemperance and brutality of the men, from which originate half the vice and crime known to our police-offices and courts of justice.

Hence women in all ranks of society should have physiology taught to them. It should be an essential subject in their primary, secondary, and higher schools. So strong are my convictions on this subject, that I esteem it a special duty to lecture on physiology to women, and whenever I have done so, have found them most attentive and interested in the subject, possessing indeed a peculiar aptitude for the study, and an instinctive feeling, whether as servants or mistresses, wives or mothers, that *that* science contains for them, more than any other, the elements of real and useful knowledge.*

* Additional arguments for the study of physiology by women may be derived from the consideration of, 1st, The effects of fashion-

In advocating the propriety, therefore, of introducing Physiology as an essential part of education to all classes of society, I would observe in the last place, that when you enter upon the duties of your profession you will find too frequently that your best efforts are frustrated by parents, nurses, or attendants on the sick, who, not comprehending, are therefore incapable of carrying out your instructions. I have myself seen, only too frequently, the most melancholy deaths produced in families, and extreme wretchedness occasioned from carelessness or ignorance of what ought to be done—entirely arising from an unacquaintance with the most common rules requisite for the preservation of life.

Gentlemen, from the superior education which you

able clothing on the young female, the tight lacing, naked shoulders, thin shoes, high-heeled boots, etc., so subversive of health ; 2d, The great object of marriage—the production of healthy offspring, and all the foresight, care, and provision required in the pregnant state, and too often neglected through ignorance ; 3d, The proper employment of women, which should be regulated with regard to their constitution and conformation ; 4th, Nursing the sick is one of the most holy occupations of women ; and need I point out how much more intelligently this would be done if they possessed physiological knowledge ? Doubtless those who regard this study as too difficult and technical for young men will decry it also for women ; yet it so happens that for them nothing is so truly interesting as this science, and when tried they have exhibited especial aptitude for it. I possess the examination-papers of two school-girls of the Ewart Institution, Newton-Stewart, which contain an amount of information in physiology perfectly astonishing. Seldom have my students given better answers. And yet it has been argued that physiology was far too difficult and technical a subject to be studied by the students in Arts of our University !

have received, you will instinctively be led in your various localities to be the pioneers of scientific and useful knowledge amidst the mass of ignorance with which we are surrounded. This indeed is the office which the members of our profession may proudly boast of having carried out successfully. Hitherto, perhaps, we have been a little too exclusive in confining physiological and medical knowledge to professional circles. I am persuaded, however, that the time has arrived when the people at large are not only prepared for, but will demand more information on all that refers to their own health and bodily welfare. If so, I can conceive no greater privilege that can devolve upon you while prosecuting your professional duties, than to assist the educational movement which shall teach mankind how to diminish the evils to which frail humanity is subject, and do all in your power not only to relieve and remove disease when present, but to prevent its occurrence. To you, as to truly educated men, not only in literature, but in science also, all classes of the community will appeal for advice in what relates to health and disease, life and death—solemn subjects—which I am satisfied you will feel can only be ultimately understood by diffusing everywhere a sound education, and teaching the people from conviction to do what is right, rather than deterring them by punishment from doing what is wrong. Ignorance, weakness, and error, are the true causes of misery, disease, and crime,

and the only radical cure for these misfortunes is carrying the light of knowledge into the dark recesses of the human mind ; strengthening the feeble intellect to comprehend the laws of its own existence, and, above all, inculcating that true religious belief which exalts the worship of the one Great Spirit—the Spirit of Truth.

